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Impact of the Oil Industry in the Changes of the Qualitative Parameters in the Waters of River Gjanica

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Abstract

Gjanica River emanates from Shpiragu Mountain and it has got a length of 70 km, with a catchment basin of 234.07 km^2. Its flow is characterized from big changes, during different seasons of the year, as well as multi-year period. They range from 0.146 to 124 m^3/sec.
In its valley are installed the two refineries that Albania has today in function, Ballshi Oil Refinery and the Fier Oil Refinery. Also along the shore of the river are stretching the two most important sources of crud oil extraction, Visoka and Ballesh. At a length of 41 km, starting from Ballshi until the meeting with the river Seman in Fier, are concentrated all industrial and urban emissions that influence in its pollution, meanwhile changing the physic-chemical nature of these waters until the destruction of the fauna and flora in it. It is estimated that every month the river Gjanica are discharged about 13 000 to 18 000 m^3 [12] of liquid waste containing hydrocarbons, industrial chemicals and oils.

Keywords: river, contaminated water, physic-chemical parameters, oil industry, hydrocarbons.

Aim: Monitoring the water quality of the river Gjanica to high levels of pollution, contains one of the main goals of this study

Background

Gjanica River emanates from Mount Shpiragu and has a longitudinal stretch of 70 km, with a catchment basin area of 234.07 km2. His flow is characterized by major changes during different seasons of the year, as well as multi-year period. The flow range is from 0.146 to 124 m^3 /sec.
The river water is bicarbonate - magnesium type. In ¾ of its length the river passes through the oil industrial area of towards S-SE-W. At its bottom part the river passes through Fier city and after that Gjanica river join Seman River, 3 km north of the city in the village Mujalli.
Environmental pollution by oil and oil byproducts has become currently a great problem of our country. The oil industry is the biggest consumer of water, so the biggest problems are:

- ✓ Ensuring a supply of clean water technology
- ✓ Cleaning wastewater discharges.

Cooled waters constitute the majority of the water used for various services in the oil refining facilities. Water cooling for these plants should have some specific characteristics like low hardness, temperature 15-17 ° C etc. [10-16]

Surface water may be used in these industries, but they present some disadvantages, they do not have constant temperature, the presence of substance like suspended substances and algae formation. Technological waters of processes are different; they are used for dilution of alkaline and acid solution to dissolve or disbanded chemical reagents. The main sources of pollution are the groups of oil collection and oil - water separation plant, their equipment and technological schemes, due to their amortization, do not provide even minimal conditions for environmental protection.

At a length of 41 km, starting from Ballesh until the meeting with the Seman River in Fier, are concentrated all industrial emissions and urban pollution that influence in the river quality. In any 7-8 km occurs industrial water discharges, changing the physical and chemical nature of the water of this river until the complete destruction of the fauna and flora in it.

In its valley are installed both refineries which today are in function in Albania, Ballesh oil Refinery & Fier oil refinery, also along the coasts of the river stretches two major deposits of crud oil, Visoka and Ballesh, Visoka was discovered in 1963 by well G -622 and the number of wells drilled reached 129. Two major crude oil fields in Albania (Visoka & Ballesh) through their decantation unit Usoja and Visoka, discharges about 560 000 m^3 /year of water in the river Gjanica. Together "with the unsparing contribution of Ballshi and Fier oil refinery" Gjanica already become one of the most polluted rivers and lifeless in Albania.[8-16]

Into the Gjanicë River are discharged:

- Technological waste waters of Ballshi and Fier Oil Refinery,
- Layer (stratum) waters deriving after decantation process Unit of Visoka and Usoja plants which are calculated over 0,56 million m3 / year and waters from Patos crude oil - bearing.
- Urban water of Fier and Ballshi city and villages of the area.

It is estimated that every month in this river are dischared around 13000-18000 m^3 of liquid waste containing hydrocarbon and industrial oils which make Gjanica the most polluted river in Albania and in addition to damaged flora and fauna, a river with no benefit for agriculture (irrigation) or livestock. This river discharge into the Seman River and then discharge into the Adriatic Sea. [8-16] Leaks at the Ballsh refinery by-products make possible the increase of hydrocarbons concentration in Gjanicë River resulting in increased content of hydrocarbons, nitrates, ammonia and phenol at higher levels than the allowed limits.

Materials and Methods

For a better understanding of what is discharged into the river gjanicë from oil extraction and oil processing industry, referring the studies of the last decade in accordance with international methodologies, and standard analisis, this study will present the monitoring of this river through its full length.

Results and Discussion

During 2003, the national petroleum scientific center under contract with the mod has carried out monitoring of surface water quality for the area kasnica-kash-ballsh (decantation facilities, oil collection systems and discharged layer water) for the indicators:

- the content of dissolved h_2s in discharged water fromdecantation and other monitoring plants;
- the content of chlorides in the water accompanying oil extraction in the group wells, decantation and hydro systems in the region where they are discharged;
- the content of the oil dissolved in water environments of the above systems in 21 monitoring stations, which are other points than those monitored during 2002 to ensure a more comprehensive information on water pollution in a wider network expansion with frequency of measurements: 3 times a year;
- the content of h2s gas in the wastewater discharged mainly is observed in the wells groups:
  - Exploitation wells;
  - Decantation plants.
- The content of dissolved oil. Oil in aquatic environments is present in thin swimming layer form and dissolved form. All the analyzed samples contain dissolved oil. The above discharges significantly affect surface water pollution of the river gjanica. The content of dissolved oil in the water is the main indicator for the assessment of pollution in aquatic environments.

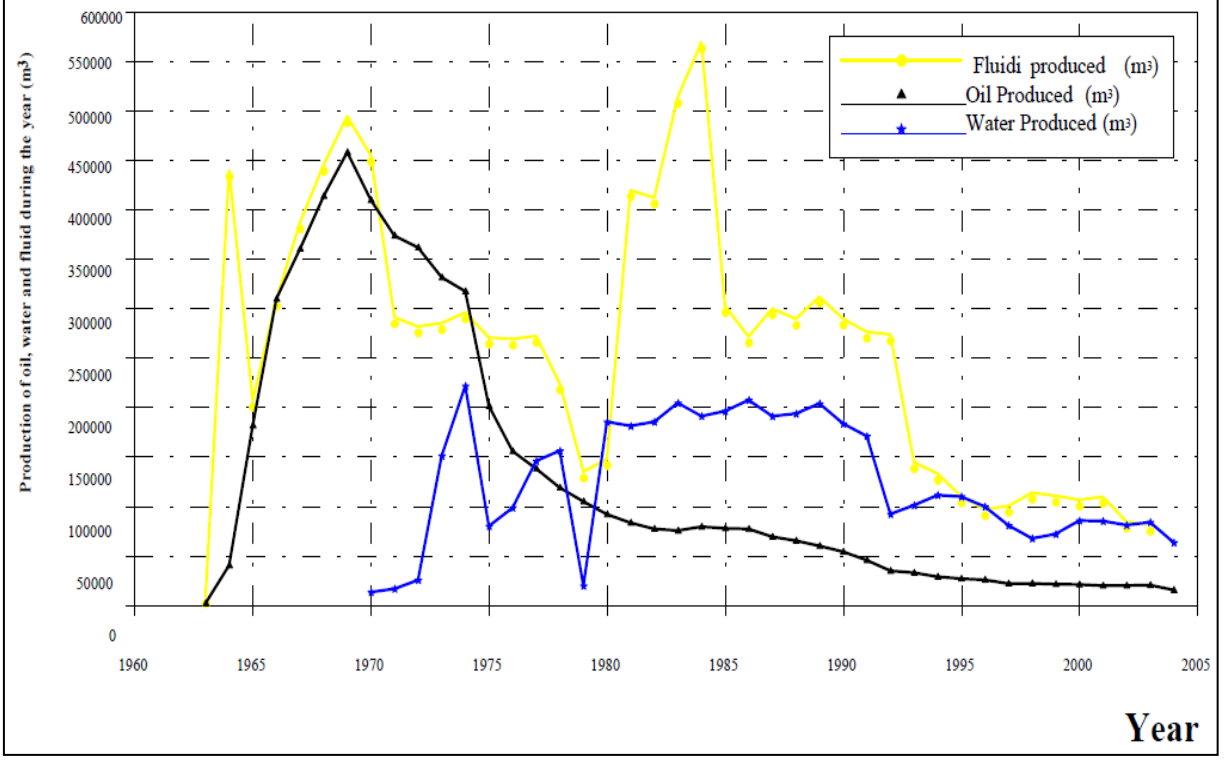
Figure 1. Contamination in Oil Wells Surface.

In the region we can mention these types of pollution:

- contamination by sedimentation waters;
- pollution from combined water (sediment waters and oil extraction accompanying waters);
- contamination of water accompanying oil extruction;
- contamination of accompanying water with low mineralization and high oil content;
- contamination of surface waters from discharges of oily water pollution;
- In Gjanica River are discharged sludges deriving from the cleaning of raw materials storage tank in quantity, 50 tons per year.

Without exception, all wells are polluted on the surface. Almost all wells are equipped with "ecological pits", but they are significantly overcrowded and polluted material collected in them is poured and spread over the surface nearby. Figure 2 shows graphically the extraction of oil, water and fluid in crude oilfield Visoka-Ballesh through years.

***Figure 2**. Graph of oil extraction, water and fluid in oilfield Visokë - Ballesh.*



Oil stains characteristics depend on many factors, ranging from the type and properties of the spilled oil, climatic conditions, and the level of the tides and the diversity of life living in the contaminated area.

Although any oil stain has its properties, we are not making any big mistake if we do a generalization of the results achieved with oil stains treated with dispergante or cleaned mechanically, wherever these processes are made.

The direction of movement and spread of oil stains, it is a natural process completely interpreted from the scientific point of view [1].

The speed of the spread of the oil spot is approximately 3.5 ÷ 4.5% of the average wind speed. Another factor that determines the speed of its spread is the level of the tides in the contaminated area. The spread vector of the oil spot is the resultant vector of the first two vectors.

The spread of the oil spot is conditioned also by the forces of gravity and the surface tension of the oil. The process of oil spot spreading too many other processes, evaporation of oil, dissolving the light factions, creating emulsions, oxidation as well as bacterial degradation.

Environmental impact assessment of an oil stain is a very interesting process, regardless if the radius of influence is big or small. Connections in time and space of the spread spot with physical, biological and chemical processes which harm the ecosystem are as follows. [1-6]

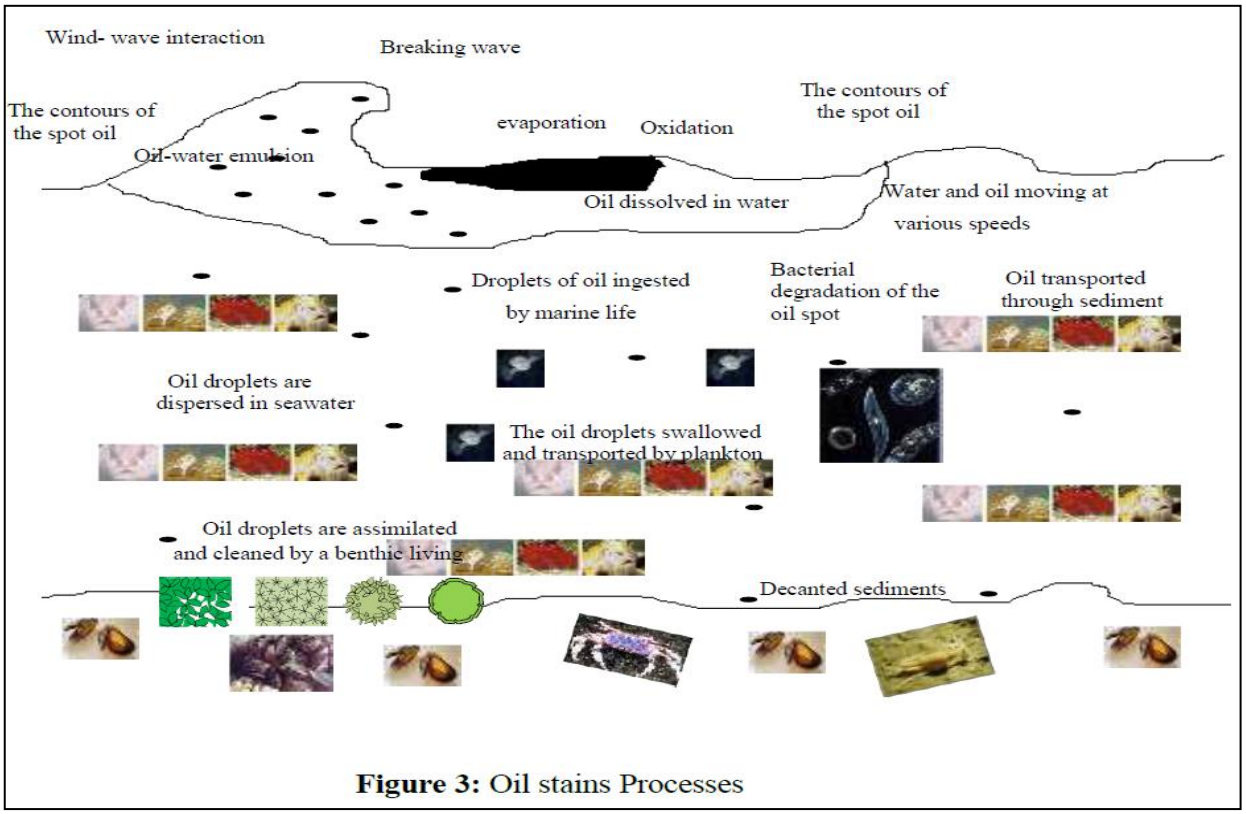


Figure 3: Oil stains Processes

From studies carried out till to date is noted that the pollution from the oil industry lies not only in the extraction and its processing arias but also in the wider areas until to the Adriatic Sea.[7-17] In this theme we make an effort to give an evaluation of the pollution degree of Gjanica river, following the contamination at five monitoring stations.

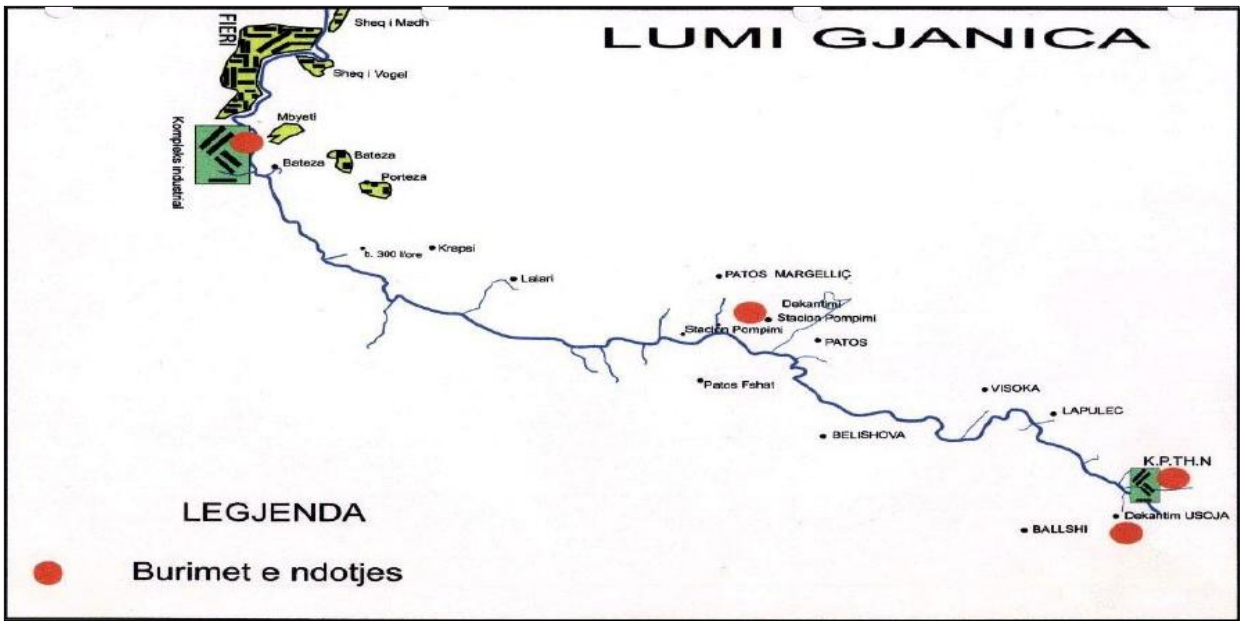


Figure 4. *Map of Gjanica River, pollution points*

To create a more accurate judgment on contamination from oil contamination of the Gjanica River, in geographic segment of 41 km from Ballesh to its delta in the river Seman in Fier, we have been testing the quality of water in some areas of study being starting from potential contamination points.

The average results of the analysis of water quality of the Gjanica river in Ballsh segment - in the meeting point with River Seman in Fier, carried out in different time periods are provided in the following tables:

Table 1. *Water Quality of Gjanica River in its geographical segment 41 km, Ballsh - L.Seman - Fier.*

Analysed Indicator	The average value *(mg/l)*					BB/IFC 1995
	Before discharges of Ballshi Oil Refinery	Segment Usoja - Visoka	Segment Visoka - Industrial Comp. Fier	After the Fier Oil Refinery	Seman River Contact point with Gjanica River	Norms *(mg/l)*
pH	6.2	6.8	6.5	7.9	7	6-9
Nitrites	-	0.33	0.37	0.35	0.15	0.06
Nitrate	-	3.3	4.5	29.5	8	10
Ammonium	missing	8.3	10	110.7	26.5	6
Iron	-	0.73	0.25	0.23	0.095	3.5
Phosphates	-	1.18	1.45	1.7	0.85	2
Phenol	missing	3.64	3.7	2.22	0.62	1
Suspen. solids	520	108	91	86.5	32	50
COD	50	150	157	559	190	150
BOD_5	48	58	54.5	102.5	55.5	50
H_2S	missing	-	2.5	2.95	0.65	1
BETEX	missing	1.25	0.09	0.52	-	0.05
Oil, Product	missing	243	363	53.5	6.75	10
Odor	missing	oil	oil	bed	Not normal	missing

Table 2. *Results of the analysis of benzene and counterparts in the Gjanica River* (mg/l)

Chemical indicators	Minimal Value	Maximal Value	Average value	Norms (BB/IFC)
Benzene	0.11	1.39	0.75	0.05
Toluene	0.26	2.4	1.33	0.05
E.Benzeni	0.04	0.31	0.175	0.05
P.Ksileni	0.038	0.22	0.129	0.05
M.Ksileni	0.092	0.61	0.351	0.05
O.Ksileni	0.09	0.59	0.34	0.05

Tests carried out indicate the high level of pollution up to several times higher over current national and international allowed value throughout the period of the year and especially when they are at work TEC, Ballsh Oil Refinery, Fier Oil Refinery and Oil Decantation plants of Usoja and Visoka.

Referring to the values in Table 1, the indicators COD and BOD_5 that respectively capture the average 264 mg/l and 65.5 mg/l, conclude that the segment of 41 km of the river is not likely to keep living beings.

From the analysis conducted at certain points throughout the course of the river Gjanicë (from Ballesh up to its reach the river Seman), among others has been observed that in the water content are present in the form of dissolved aromatic hydrocarbons of benzene chain; their results are highlighted in table 2.

The maximum value of benzene reaches 1:39 mg/l and toluene 2.4 mg/l, while other counterparts' values come on the landing. However, despite the results of the analysis, the presence of these hydrocarbons in the marine environment should be kept always under control because they are classified as carcinogens. What is striking is the high level of oil and its derivatives in these waters; the average value is 166.6 mg/l and fluctuates in max. Value 363 mg/l and the min. value 6.75 mg/l (the meeting point Gjanicë River-Seman River), from 10 mg/l which is the current rate allowed. From the analysis of qualitative indicators of river Gjanica water quality, above it can be observed that all qualitative indicators are higher than norms. As a result of these emissions, pollution of Gjanica is very high that can be considered lifeless from the ecological point of view and can be classified as a dead river. With regard to fauna and flora, we can say that minwhile they are reduced to a minimum or do not exist. Below we present a collage of photographs that are shocking evidence of environmental pollution of Oil Industry, taken at different times and at present in Gjanica River.

Figura 5. Lumi Gjanicë para shkarkimeve të Kombinatit të Naftës, Ballsh (Maj 2012).

***Figura 6:** Lumi Gjanicë pas shkarkimeve të Industrisë së Naftë (2011)*

Figura 7: *Lumi Gjanicë brenda qytetit të Fierit*

Conclusions

Finally we can say that:

• Gjanica River is much polluted particularly relevant indicators: total petroleum products and sulfur as H_2S, suspended solids etc.

• The degree of pollution in general is increasing by the second monitoring station (after waste water discharged from Ballshi Oil Refinery), especially in the third monitoring station (after water dischared from waste oil wells Visok) and station fourth (after discharged of waste oil processing plant in Fier). Further the level of pollution is increased mainly due to raw urban sewage of Fier city discharges directly into the river.

• Gjanica River polluted by waters of decantation plant of Usoja and Visoka, in particular with chloride, gases sulfihidrik, sulfur and raw surfactant pollution, followed by discharges of industrial area of the Fier city till the meeting point of the river Gjanicë with river Seman.

• Study (Project Idea) the improvement of the internal network scheme of technological water to the refinery, with the aim of collecting all the water discharged from the process unit and sent their water to the waste water treatment plant.

• Study (Project Idea) of new technologies appropriate to our industry of waste water treatment plant of Ballsh Oil Refinery.

• Study (Project Idea) of new technologies appropriate to our industry of water and soil treatment from deposits filds of oil extraction.

References

1. Agrawal, K.M., Sikdar, P.K., Deb, S.C. *A Textbook of Environment.* Macmillan India Limited, Kolkata. 454 pp, 2002.
2. Bhagi, A., Chatwal, G.R. *Environmental Chemistry.* Himalaya Publishing House, Girgaon, India. 506 pp, 2003.
3. Bharucha, E. *Textbook of Environmental Studies.* Universities Press, Hyderabad, India. 276 pp, 2005.
4. Bhatia, S.C. *Environmental Pollution and Control in Chemical Process Industries*
5. Khanna Publishers, New Delhi. 1133 pp, 2001.

6. Brady, N.C. and R.R. Weil 1999. *The Nature and Properties of Soils (12th Edition), Upper Saddle River,* Printice Hall, New Jersey
7. Alqi Çullaj (2004); Instrumental Methods of Chemical Analysis . Tirana. Pp
8. Pranvera Lazo, Alqi Çullaj (2008); Instrumental Methods of Analysis. Tirana. pp.
9. Vataj E, et al. (2011); Using fluorescence method of energy dispersive X radiation for the study of objects of glass. Bulletin of Natural Sciences ; No. 12. (2011); Tirana, 62-74.
10. Ministri e Industrisë dhe Energjetikës. Industria e Naftës dhe e Gazit në Shqipëri Tiranë; 2003; 99 -131, 156-204.
11. Beqiraj I. Monitorimi i tregut shqiptar të hidrokarbureve. Tiranë. 2008; 5-6; 54-56; 112-116; 127 – 134; 159
12. Seiti B. Ndotja, impakti mjedisor dhe reduktimi i saj në rajonet e përpunimit të naftës në Shqipëri. Tiranë; 2007; 8 – 118
13. METE. Industria e Naftës dhe e Gazit në Shqipëri. 2005; 248 – 259.
14. Instituti i Higjenës. Metodat e trajtimit fiziko-kimik të ujrave. Tiranë; 1984.
15. Guri S. Vlersimi i nivelit të ndotjes dhe rekomandimet përkatëse në fushën naftë gazmbajtëse. Tiranë. 2010; 51 -129
16. Fakulteti i Gjeologjisë dhe i Minierave (Departamenti i Burimeve të Energjisë)
17. A.R.M.Fier.